ED 197 853 IR 007 425

AUTHOR Hamilton, Frank L.
TITLE Problems and Answers for School Districts.
PUB DATE 28 Feb 79
NOTE 9p.; Paper presented at the Annual Convention of the American Association of School Administrators (107th, Atlantic City, New Jersey, February 25-28, 1979)

EDRS PRICE MF01/PC01 Plus Postage
DESCRIPTORS Computer Programs; Computer Science; Electronic Data Processing; Elementary Secondary Education; *Scheduling; *Student Transportation
IDENTIFIERS New York (New Paltz)

ABSTRACT

The New Paltz, New York, school district has used the IBM Vehicle Scheduling Program (VSP) for scheduling its bus runs. In the process the district has reduced its transportation costs by 33.4 percent over a two-year period. (CTT)

[illegible] [illegible]

[illegible]

[illegible]

SUBJECT: Remarks by Superintendent of Schools for Business Men [illegible]

TOPIC: Problems and Answers in School Busing

PLACE: Room 1, Courthouse Mall

TIME: [illegible] P.M., Monday, February 27

PRESENT: Page 77

Summary of Remarks

I receive inquiries from all over the United States regarding the use of computers in route and schedule school buses. Now White Plains schools are aware of the need to update their methods of determining how the children are picked up for school.

The economics of today give an added importance to school peoples need to automate their procedures.

This afternoon I will talk about one method available to you.

In the 1969-70 transportation budget was $218,535.00. In 1970-1971 the budget increased to $254,350.00 a decrease of 15.8%. In 1971-1972 the budget [illegible] a decrease of 15.0% over a two year period. This was accomplished even though costs of supplies and labor increased dramatically.

I mention this in the beginning because the advantages of the use of computerization of school bus routes here indicate to me that they are not reduction in budget. As you can see this was not the case in New White.

Now then I hope that here you are keen that you should try to institute a procedure in your district, I will return to my story on why and how we became a pioneer in this area.

New White is located in the historic Hudson Valley of New York State. We are surrounded by IBM plants which may account for the fact that we have availed ourselves of every means available to improve our school's application through the use of computers. We believe that routine tasks are better accomplished by properly programmed computers. We believe that the more data available to you makes your decision making easier. We have had a relatively short time progressed from Unit record equipment to a 370-125.

Through the use of some overhead transparencies and slides I hope to be able to guide you through the process necessary to you to develop and use VSP. If you decide to use an outside company, you will have some idea of what service they will provide you with. I believe that regardless of what system is used the same data must be obtained.

Many schools are faced with the problems of racial imbalance and they need to have available to them an immediate way of determining bus routes so as to meet State or Federal mandates. This provides that service -- need I say more.

These remarks were made by [illegible] Dick Hill computer center

As the era of the space exploration age it became that we have to come up with some sort of [illegible] which could alert parents that children were on the road.

At a [illegible] meeting I was asked by the people of a certain phase of computer how much it would cost with the number of bus routes available.

I was able to verify that if I could get on the computer at the moment I could have that information available by noon.

Unless you have automation there is no way you can actually make this type of [illegible].

[illegible] Bay [illegible] was one of the first to computerized bus schedules to help solve school busing problems.

I emphasize is a workshop being conducted at Syracuse, N. Y. to learn more about this method. I was fortunate to have [illegible] there at their expense the system experience so that it could also become familiar to be in a position to help. It proved to be a most educational visit. As a result of this experience we commenced with the initial work as soon as the class was over and we had returned home.

I understand that TSI is currently not offering this service, but I am sure the same information can be obtained from a workshop run by the State Boys.

Is there [illegible] part of schedules of students by classes or schedules of students [illegible] by bus [illegible] the same purpose.

Do you have some [illegible] or student class schedules that you have completed by hand scheduling which must be resolved manually ....but which do not create large problems.

What I will try to do this morning is give you an overall view of this application so that you may be aware of how it has worked in New Paltz. I will try to be sure and point out both the good points and the weak points in the system. I will also mention an improved program called VST which I have used and found beneficial to our operation.

Many of the same problems found in commercial routing are also found in school bus routing, which has, as well, unique problems. VST was originally designed to fill a [illegible] gap in the overall cycle of a typical business where the movement of vehicles over [illegible] was involved. We have found that VST is applied to school busing indicates that similar improvements may well occur in this area.

Just some statistics about New Paltz.....We transport 2300 students, operate all district owned equipment with 34 passenger buses and 6-16 passenger vehicles. Last year we ran 3,400 miles in route. We have one high school, 6-12, a Middle School 5-8 and one elementary K-4. We also transport to the Campus Learning Center 6th K-8 and a two room school in Gardiner.

Faced with increased requirements and ever faster rising costs, the field of education today has quite literally become everybody's problem.

One particularly difficult part of this problem involves the routing and scheduling of a fleet of buses to or from a school in an efficient manner.

[illegible] it is desired to use the least number of buses possible within our time limit and seating capacity to do the job. Doing this will keep our costs within budget and state limitations.

more

The [illegible] there is a certain distance, a certain time and a certain expense to be [illegible].

Each of you, given the necessary time and information could take a map of the school district, mark on it where the bus stops are, how many students there are at each stop, then draw a line connecting up the stops and come up with a route that would bring the students into school.

I am sure [illegible] that if each of us here were to do this, we would come up with a possibility of a different bus route than each participant in this room, for the same fifty children.

The factors involved in routing are familiar to all of us. Such items as [illegible] can the same bus pick up riders at two given stops five miles apart. Is it feasible to place these students on the same route. These are some of the complications in our work.

For instance, a bridge with a limited weight capacity may prohibit the use of large buses or in the case of [illegible] a small mountain road may limit the bus size. Today handicapped children also pose a problem which the computer can accommodate.

Now let's talk about the computer program itself.

It consists of two principal parts:

1. The Network analysis program
2. The Schedule Production Program

I should make it clear at this point that I am not a technician. I make no pretense of understanding the [illegible] internal workings [illegible] [illegible].

THE NETWORK

Network analysis determines the distance and traveling time between each pair of potential stops to points. However, the resulting file is then reduced to contain only those sets of pairs that represent practical combinations of student pickups. The final output is arranged so that the pair with the largest savings obtainable by placing both deliveries on the same vehicle first. This file is referred to as the Savings File and becomes input to Schedule Production. The network shows how [illegible] connect in every possible combination of roads by the use of numbers. The computer analyzes the network of potential students to be picked up. This is a map of our school district which comprises about 165 square miles. As you can see we have inter-connected every possible intersection so that the computer can route a bus along any road it wishes. In other words when you first run network the computer will have information available which allows it to know how the bus could get from this corner of the district to the extreme other end. The computer [illegible] programmed will do this going over the shortest route possible observing any barriers we may have put in its path such as detours, one way roads, small bridges etc. If it sounds complicated, it's really not.

The first time we had our routes on the computer it was an interesting experience to wait the approximate six minutes necessary for the computer to accomplish its search and then look at the print out showing the bus routes. We ran the same students through the computer that we were [illegible] on transportation to make sure we were in the ball park.... When we came close we knew we were right and that all had not been in vain.

The network will be the most time consuming part of setting up the system.

more

It may be done by the true distance method or by the coordinate method. The true distance method consists of actual road distances between points. The coordinate method utilizes coordinates to derive approximate straight line distances. While data collection for the coordinate method is simpler, greater accuracy is obtained through the use of the true distance method.

Perhaps it is fortunate that we already had our district travel data that we will work with. Since the file of a mile-per-hour speed is fairly small, although the area covered is of some value to a part of our clientele records. It is hard to do very well for a very profitable area such as that the requirements of the USE program.

It took a systems engineer and an I.B.M. card key punch operator to complete the network. When we were finished and the computer had checked out each of the cards, only one flaw.

Each link used in our network also contains the distance between the two points together with the speed the bus can travel over that particular route. We found that a map could be very helpful for us as we used the true distance method. We found drivers who were familiar with the roads to give us the speed that could be traveled.

Just for your information - here terms that I am using are built around in an interesting collection of words and the link - a node is made between two nodes.

The shortest distance program uses the output of the network description, however this file is also to be used by all the general transportation programs and a complete description of the file, although a number but for vehicles and a record of the file will follow.

What I am trying to get to, you have your network. This is now a deck of IBM cards called the cards, we have cards one note of another linking up one future another with another. Also input to us the card is the distance between those links and the speed that bus can travel. Next you must tell the computer what options you'd like to exercise. The school is traditional program might many options applicable to schools. Options selection permits the tailoring of bus scheduling to specific local demands. The step options most applicable to schools are:

Limited or specific waiting time per stop
Average travel time for all stops (allowing for acceleration, slowing down, and other routine motions.)
Special time for an individual stop
Vehicle limitations (stop if able or special stops)
Average vehicle speed for the fleet
Earliest possible starting time, latest possible finishing time
Maximum route time
Maximum number of stops per route
Average unloading time per student

All of the options may be used separately or in combination to parallel closely a unique bus scheduling situation.

All of these options are much a matter of the location of one card into the proper place to be read into the computer.

[illegible] SAYING [illegible] POINT [illegible]

[illegible] A MAP OF THE SCHOOL DISTRICT, [illegible] THAT IN [illegible] THE COMPUTER [illegible] AVAILABLE [illegible] CAPACITY [illegible] AVAILABLE [illegible] WE ALSO [illegible] THE STOPS ARE LOCATED..... [illegible]

AFTER ALL THIS INFORMATION IS FED INTO THE COMPUTER IT TAKES ABOUT SIX MINUTES [illegible] YOU HAVE YOUR [illegible] AND [illegible] CALCULATION [illegible].

IT [illegible] IN ACTUAL PRACTICE [illegible] A GREAT DEAL OF WORK ON THE PART OF [illegible] FOR ROUTING YOUR SCHOOL BUSES AND YOUR DATA PROCESSING [illegible] TO [illegible] MAKE CERTAIN [illegible] INFORMATION AVAILABLE.

HOWEVER, TO DO THE SAME [illegible] BY A MANUAL METHOD ALSO REQUIRES A GREAT DEAL OF TIME. AS I INDICATED EARLIER, [illegible] ROUTING A BUS MANUALLY [illegible] AT LEAST [illegible] COMPUTER YOU KNOW THAT [illegible] AS FAR AS MILEAGE AND [illegible] ARE CONCERNED AND [illegible] WITHOUT MODIFICATION.

OUR SUPERINTENDENT WAS SKEPTICAL ABOUT USING VSP. HE HAD BEEN [illegible] WAITING FOR [illegible] BECAUSE I [illegible] AND HE HAD [illegible] BUT HE TURNED TO ME AND SAID, "YOU MUST THINK THIS IS GOING TO WORK" ..... IT WILL WORK FOR YOU IF YOU DESIRE TO WORK TOGETHER ON IT ... NOT FOR THE PURPOSE OF CHANGE FOR CHANGE SAKE ..., BUT FOR THE BENEFITS OF [illegible] THAT CAN BE ATTAINED.

IN SEPTEMBER 1970, WE ACTUALLY STARTED ROUTING OUR HIGH SCHOOL BUSES ON ROUTES DESIGNED BY THE COMPUTER. WE DID OUR INITIAL WORK IN FEBRUARY SO WE HAD [illegible] TIME TO EVALUATE THE OUTPUT. [illegible] TO FULLY [illegible] VSP [illegible] AND [illegible] OF THE DIVISION OF [illegible] SERVICES, FIRST TOOK OUR OUTPUT [illegible]. THEY [illegible] CAME DOWN TO NEW PALTZ AND WE TOOK THEM AROUND ON SOME ROUTES SO THAT THEY COULD ACTUALLY SAY THEY HAD SEEN VSP IN ACTION, THAT THEY HAD ACTUALLY [illegible] A ROUTE DESIGNED BY A COMPUTER. THE STATE EDUCATION DEPARTMENT'S [illegible] OF [illegible] TRANSPORTATION [illegible] HAS BEEN [illegible] UP TO THIS TIME. I HAVE [illegible] THAT THEY WILL IN THE FUTURE, SUPPORT THE DISTRIBUTION AND EXPERIMENTATION OF VSP.

VSP OR COMPUTERIZED TRANSPORTATION SCHEDULING IS NOT ONLY A DYNAMIC TOOL USED TO EFFECTIVELY SOLVE [illegible] PROBLEMS OF [illegible] SCHEDULING, IT IS ALSO A PLANNING TOOL FOR [illegible] IN EDUCATION TRANSPORTATION.

What if a large new subdivision is built? What if we changed our hours for a school? What is the probable effect of a proposed new school site?

more

Shortly after my talk, the Board of Education at a Parent night indicated to me that they would like to know what the key routes would be for four different possible elementary school sites. They further indicated that they needed this information by the following Monday night for a public meeting. I would have only a few hours work upon available information and the Board would have to [illegible] and in the evening [illegible] at this meeting. The public at that meeting [illegible] at this time. My question was, is this a test or is this to be a public meeting, and indicated that I would open up at least [illegible] to that area school, worked out by computer we will send X number of buses to each school site ..... This information will be analyzed by the public. I am sure that all of you have this same type of information to provide.

Another example would be, we are now [illegible] at work at changing school hours .... I am in their condition and with the help of ECC's here in New Paltz we were able to produce routes which showed that to do what they wished would have cost an additional five buses or $90,000. in our budget. Needless to say, the [illegible] did not change to this extent ..... If I had worked this out myself I or some [illegible] would not have been accepted as valid fact. Another advantage is that the previous requirements can be kept routine in advance. We may not plan to route the school buses in however but the following September but we need to know for budget purposes how many additional buses we will need for the following school year.

This method of routing and scheduling opens up new concepts of scheduling .... by that I mean that we [illegible] have been scheduling buses over the same routes for a period of time and to going in a certain way. And we quite often do not move them as we should and when you look over the routes ..... at least I said to myself ..... why didn't I think of doing it that way.

Now what are the disadvantages ..... because certainly there are and I am not about to tell you there are not

1. Schools with good manual scheduling systems may be reluctant to become involved in the extra work.

2. It would be nice to have the pins out more often so to the road it seems for you to travel ..... Some human determination must be made.

3. The computer does not produce a map, only a route schedule .... This takes time to convert into a route on a map. However, I must say that in two hours I am able to do 40 routes.

4. By products such as bus cards, time at individual stops and meter directions need to be developed.

HOW SHOULD A DISTRICT PROCEED TO IMPLEMENT AN AUTOMATED SYSTEM .....

1. There should be general agreement among the Board of Education, superintendent, and transportation personnel that they are willing to experiment.

more

4. Budget [illegible] allocations must be made ..... Our total cost on the initial run was about $[illegible] ..... This is about 75% for machine originated and 25% for computer time.

5. [illegible]

6. When you [illegible] ..... I will [illegible] the most data [illegible] It is [illegible] I would suggest that the [illegible] ..... In my case it was only ..... I have both data processing and [illegible] responsibilities.....

We do not do .....

For the [illegible] - We can provide cost savings such as I was mentioned previously where we have reduced our costs by [illegible]

For the [illegible] - can provide you in five to 10 minutes with cost of the data that would otherwise take days to work out.

For [illegible] - It provides accurate data for building the budget process as it ties to new plant and construction of new facilities ....

Every manufacturer can achieve a new dimension of control ..... It is a dynamic tool and it will [illegible] the immediate results of [illegible] decisions.

#####